PATENT

IN THE SPECIFICATION:

Please amend the specification with the following rewritten paragraphs:

[0001] This invention relates to a cooling fin structure and a fin assembly and, more particularly, to a cooling fin structure and a fin assembly capable of reducing thermal contact resistance and maintaining stability in the ~~welding~~ soldering process during fabrication.

[0002] Nowadays, the cooling fin is mostly manufactured through aluminum extruding. However, the fabricated cooling fin is limited in the ratio of its height to its thickness due to current performance of aluminum extruding, and thus its capacity of heat dissipation cannot be further improved. Under this circumstance, a soldering~~welding~~ process may replace the aluminum extruding process during the fabrication of a fin assembly so as to meet a high heat dissipation requirement for modern electronic devices.

[0003] FIG.1A is a perspective view of a conventional cooling fin 102 used in the soldering~~welding~~ process. As shown in FIG. 1A, the cooling fin 102 with an L-shape cross-section is formed by a thermally conductive sheet bent to form a wide heat radiation part 102a and a thin bonding~~welding~~ part 102b. Referring to FIG. 1B, when each cooling fin 102 is ~~welded~~ soldered to a substrate 104 and orderly arranged thereon, a fin assembly 100 manufactured by the soldering~~welding~~ process is formed.

[0004] During the soldering~~welding~~ process, in order to remove surface oxide and increase surface wetness, ~~welding~~ flux are often added on the soldering~~welding~~ area. However, when the soldering~~welding~~ process is finished, a large amount of the ~~welding~~ flux left on the soldering~~welding~~ area may worsen the soldering~~welding~~ quality and increase the thermal contact resistance between the cooling fin 102 and the substrate 104.

[0005] Referring to FIGs. 1B and 1C, because the cooling fins 102 affixed to the substrate 104 are combined to form the fin assembly 100 with their ~~welding~~ bonding parts 102b being closely adjacent to each other, the squeezed ~~welding~~ flux underneath each ~~welding~~bonding part 102b is blocked by end surfaces of its adjacent ~~welding~~ bonding parts (such as surface A-A shown in the diagram). Therefore, a large amount of the ~~welding~~ flux are left on the soldering~~welding~~ area between the cooling fin 102 and the substrate 104, thus considerably deteriorating the soldering~~welding~~ quality and increasing the thermal contact resistance between the cooling fin 102 and the substrate 104.

[0006] An object of the invention is to provide a cooling fin structure and a fin assembly capable of reducing thermal contact resistance and maintaining the stability in the soldering~~welding~~ process during fabrication.

[0007] According to the invention, a cooling fin structure is constructed by a thermally conductive sheet bent to form a heat radiation part and a ~~welding~~ bonding part. The ~~welding~~ bonding part is formed with a vacant region, which is defined by notches, openings or a slot, and the thermally conductive sheet is ~~welded~~ soldered to a substrate through the ~~welding~~bonding part.

[0008] Through the design of this invention, when each cooling fin is ~~welded~~ solder to a substrate, the vacant region on the ~~welding~~ bonding part allows part of the surface area of the substrate not to be covered by the ~~welding~~ bonding part between two adjacent fins can serve as an additional space on the substrate to accommodate the squeezed ~~welding~~ flux and the surplus solder. Hence, a large amount of the ~~welding~~ flux and surplus solder are removed from the soldering~~welding~~ area between the ~~welding~~ bonding part and the substrate, thus improving the ~~welding~~ soldering quality and decreasing the thermal contact resistance.

[0017] Referring to FIG. 2A, a cooling fin 12 with an L-shape cross-section is formed by a thermally conductive sheet bent to form a wide heat radiation part 12a and a thin ~~welding~~ bonding part 12b. The thermally conductive sheet is bent through sheet metal work, and its materials may be aluminum, copper, aluminum alloy, copper alloy, or their compounds.

[0018] According to this embodiment, the ~~welding~~bonding part 12b is indented to form a row of notches 14, which cause the bonding~~welding~~ part 12b to have a serrate edge. The notches 14 can be in any shape, and the number of them is not limited. Referring to FIG. 2B, when each cooling fin 12 is soldered~~welded~~ to a substrate 16 and orderly arranged thereon, all the bonding~~welding~~ parts 12b cover one surface of the substrate 16, and part surface area 16a of the surface is not covered by the ~~welding~~bonding part 12b between two adjacent fins. The substrate 16 may be made of aluminum, copper, aluminum alloy, copper alloy or their compounds.

[0019] FIG. 2C is an enlarged partial plan view of FIG. 2B. Referring to FIG. 2C, because part surface area 16a on the substrate 16 is not covered by the ~~welding~~ bonding part 12b between two adjacent fins, they can serve as an additional space to accommodate the squeezed ~~welding~~ flux 18. In other words, when the cooling fin 12 is soldered~~welded~~ and pressed on the substrate 16, the ~~welding~~ flux 18 contained in a solder is squeezed from the

~~welding~~ soldering area to the predefined areas 16a, so that most of the ~~welding~~ flux 18 is not left on the ~~welding~~soldering area between the ~~welding~~bonding part 12b and the substrate 16.

[0020] During the ~~welding~~soldering process, in order to remove surface oxide and increase surface wetness, ~~welding~~ flux is often added on the soldering~~welding~~ area. However, when the ~~welding~~soldering process is finished, a large amount of the ~~welding~~ flux left on the ~~welding~~soldering area may worsen the soldering~~welding~~ quality and increase the thermal contact resistance. For instance, a foaming operation is usually used in applying the ~~welding~~ flux on the ~~welding~~soldering area, and this may generate many bubbles inside the ~~welding~~ flux. In that case, when a large amount of the ~~welding~~ flux is left on the ~~welding~~soldering area, the bubbles with extremely low thermal conductivity can cause a considerable increase in the thermal contact resistance between the cooling fin and the substrate, and they also render the soldering~~weld~~ unsteady and thus worsen the soldering~~welding~~ quality. However, through the design of the invention, the ~~welding~~ flux 18 is almost removed from the soldering~~welding~~ area between the ~~welding~~bonding part 12b and the substrate 16, thus improving the soldering~~welding~~ quality and decreasing the thermal contact resistance.

[0021] Also, through the design of the invention, not only the ~~welding~~ flux left on the soldering~~welding~~ area but surplus solder is squeezed into the predefined area 16a; this reduces the thickness of the ~~welding~~ soldering medium interposed between the cooling fin and the substrate and further decreases the thermal contact resistance as a result.

[0022] Referring to FIG. 3, the ~~welding~~bonding part 12b of the cooling fin 12 is formed with a plurality of openings 22 instead of notches. The shape of the opening 22 is not limited to a circular shape shown in FIG. 3 but can be in any shape, such as a polygon and an irregular shape, and the number of the openings is not restricted. Referring to FIG. 4, the ~~welding~~ bonding part 12b of the cooling fin 12 is formed with a slot 24 instead of notches. From all such modifications, it can be understood that the ~~welding~~bonding part 12b is required only to provide a vacant region defined by the notches 14, the openings 22 or the slot 24, and that the shape, number and area of the vacant region is not limited. Thus, the vacant region can serve as an additional space on the substrate to accommodate the squeezed ~~welding~~ flux and the surplus solder.

[0023] Further, the L-shape cross-section of the thermally conductive sheet is for exemplary purpose only, and the way of bending the thermally conductive sheet is not limited. For example, the thermally conductive sheet may be bent to form a triangular cross-

section, with its bottom portion being formed with the vacant region to act as the ~~welding~~bonding part.